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Market Power Analysis of Soybean Commodity In East Java

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Abstract

The purpose of this study is to analyze the market power of soybean price. Data used in this research was the statistic data of Time series (1989-2008). Data was estimated by using OLS (Ordinary Least Square). Before estimating the data, the stationary condition of every variable was tested by using ADF Test (Augmented Dickey-Fuller Test). The results found that market power significantly affects soybean price, value of conjectural elasticity 0.39162. Market power can increase the price of processed soybean products amounted to 38.8161 percent in output markets and increase the wholesale price of soybean 19.3981 in the input market. Soybean prices are set by government policy to encourage the local soybean production increased from farmers and to the development of soybean industry, need to consider the influence of market power on soybean price.

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1. Introduction

Oligopoly in soybean market can be indicated by the authority of some soybean wholesale traders and industries which use soybean as raw material. In oligopoly market, the wholesale traders or soybean industries have the power in deciding the price, the maximization profit is gotten when *marginal revenue* (MR) is equal to *marginal cost* (MC). Oligopoly power in pricing will be bigger if there is collusion among oligopolies.

The power of oligopoly market in pricing strongly depends on demand elasticity and conjectural, when the high farmers' supply will lower the price that the farmers get because of the demand inelasticity and supply elasticity which reactivate to the price changing in the stagnant farmers' selling price (Appelbaum, 1979 and Sexton, 1990).

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Beside conjectural elasticity, another indicator which can be used to measure the power of oligopoly market in pricing is Lerner index (Sheperd, 1990). In this research, market power was analyzed from conjectural elasticity.

According to Chalilet al. (2006), market power created by oligopoly is often seen as a problem because it often creates inefficiency, decreases social welfare, and leads an unfair condition in income distribution among marketing agents. Because of that, the government intervention is needed to decide a policy which can give contribution in social welfare, the efforts of increasing the soybean farmers' income and the development of soybean industry.

The problem of this study is how big the influence of market power to soybean price is. Related to that problem, this research purposes to analyze the influence of market power to soybean price.

2. Materials and Methods

2.1. Market Power Measurement Model

2.1.1. Lerner Index

In 1934, A.P. Lerner served the concept of monopoly and its measurement. He considers monopoly level as price proportion which is signed by marginal cost. Later, this concept is known as Lerner Index that is specifically formulated by Sheperd into (Sheperd, 1990):

$$L = \frac{p - mc}{p} \tag{1}$$

L = monopoly level or Lerner Index, mc = marginal cost, and p = output price. Lerner (1934) defines monopoly power level as monopoly revenue percentage per output unit. On the other words, it can be also defined as markup percentage above marginal cost. In the perfect competitive market, there is no markup, and Lerner Index (L) is zero. On the other hand, in pure monopolistic, Lerner Index is one.

In profit maximization when marginal cost is equal to marginal revenue, Lerner Index may be the inverse of demand elasticity.

$$\frac{p - mc}{p} = -\frac{1}{\varepsilon} \tag{2}$$

Based on this equation, the low demand elasticity can cause industry to have a high power market. In high demand elasticity, price ascending can influence consumers to lower their demands. Because of that, seller cannot control the high price. The demand elasticity of industry is still earmarked by market demand and the supply elasticity of other industries;

$$\varepsilon^{j} = \frac{\varepsilon_{d} - \varepsilon_{s}^{j} - m^{j}}{m^{j}}$$

and Lerner Index can also be written as:

$$\varepsilon^{j} = \frac{\varepsilon_{d} - \varepsilon_{s}^{j} - m^{j}}{m^{j}} \tag{3}$$

m^i means industry, m^j means market share,

$$\varepsilon_s^j$$

Refers to supply elasticity of other industries, and ε_D is market demand elasticity. Market demand elasticity and supply elasticity can control monopoly market. The stronger the elasticity, industry elasticity will be stronger too, and monopoly power will be weaker. This Lerner Index version is often used in studying the market power of dominant company (Chalil et al., 2006).

Lerner Index can also be modified as the measurement of monopsony power (buyer power). It is different from monopoly/oligopoly power:

$$\frac{mv-p}{p}=\frac{1}{\eta} \tag{4}$$

or

$$\frac{mv-p}{p}=\frac{\xi}{\eta} \tag{5}$$

In dynamic frame, based on the first order condition of cost adjustment model (Carlton and Perloff, 2000) Lerner Index can be written as:

$$\frac{p_t-c_t}{p_t}=-\frac{\theta_{it}}{\varepsilon_t}+\Delta \tag{6}$$

Where

$$\Delta=\frac{\gamma_t+\partial\mu_{it}-\beta\left[\frac{dJ_t(q_t,v)}{dq_t}+\frac{dJ_t(q_t,v)}{dq_j}\right]}{p_t}$$

Shows the different index with one static, μ_{it} = q_{it} –$q_{i,t-1}$the difference among output when *t* and *t-1*. In dynamic index, power market is not only controlled by the effect of industry reaction to the sum choice resulted by industry.

$$\theta_{it}=\frac{\partial Q_t}{\partial q_{it}}=\frac{\partial(q_{it}+q_{jt})}{\partial q_{it}}=\frac{\partial q_{it}}{\partial q_{it}}+\frac{\partial q_{jt}}{\partial q_{it}}=1+v$$

and market demand elasticity (ε_t), but also from adjustment cost and *direct dynamic externality* (DDE), which become the effect of future choice to self-choice,

$$\left[\beta\left(\frac{dJ_t(q_t,v)}{dq_t}\right)\right],$$

and also *indirect dynamic externality* (IDE), is the effect of company future choice to the present choice

$$\left[\beta\left(\frac{dJ_t(q_t,v)}{dqj}\right)\right]$$

By interpretation and similar steps, the measurement of oligopsony power can be written as:

$$\frac{mv_t - p_t}{p_t} = \frac{\phi_{it}}{\eta_t} + \Gamma \tag{7}$$

Where

$$\Gamma = \frac{\gamma_t + \partial\mu_{it} - \beta\left[\frac{dJ_t(q_t,v)}{dq_i} + \frac{dJ_t(q_t,v)}{dq_j}\right]}{w_t},$$

mv_t is marginal value when t and p is input price in time t. Another version of dynamic Lerner Index was found in Hunnicutt and Aadland study (2003) in Chalil et al. (2006), which uses inventory border to get a dynamic condition and determine discount profit

$$\sum_{t=0}^{\infty}\beta^t = \left[(p(y_t) - w(y_{g,t}, S_t)\right]y_t^j - c^j(y_{(t)}^j) \tag{8}$$

y, w and S are input aggregate or output supply in a certain period. Supply function inverse and stock level, successively can be written into,

$$R^j = \frac{dy}{dy^j}$$

and $S_{t+1} = f(S_t, y_{g,t})$ first order condition is written into:

$$\left\{p_t - w_t - c_t^j\right\} + \left\{p_t - w_{y,t}\right\}y_t^j R_t^j + \beta\left\{p_{t+1} - w_{t+1} - c_{t+1}^j\right\}\frac{dy_{t+1}^j}{dS_{t+1}} f_y R_t^j$$

$$+\beta = \left[\left\{p_{t+1} - w_{y,t+1}\right\}y_{t+1}^j f_y R_t^j \left[\frac{dy_{t+1}^j}{dS_{t+1}}\right] R_{t+1}^j + \frac{\partial y_{t+1}^j}{\partial S_{t+1}}\right] - w_{S,t+1.t+1} f_y R_t^j = 0 \tag{9}$$

The measurement of oligopoly power is equal to Lerner Index, in this case it will become:

$$L_t^{cl} = \frac{p_t - w_t - w_{y,t} y_t^j R_t^j - c_t^j}{p_t} = -\frac{p_t}{p_t} y_t^j R_t^j + \Delta = -\theta_t^j \varepsilon_t + \Delta \tag{10}$$

$$\Delta = -(\beta f_y R_t^j / p_t)\left[A_{t+1}(dy_{t+1}^j / dS_{t+1}) + N_{t+1}(\partial y_{t+1}^i / \partial S_{t+1}) - w_{S,t+1} y_{t+1}^j\right]$$

Or oligopsony power

$$M_t^{cl} = \frac{p_t - w_t + p_t y_t^j R_t^j - c_t^j}{w_t} \tag{11}$$

$$= \frac{w_{y,t} y_t^j R_t^j}{w_t} - \frac{\beta f_y R_t^j}{w_t}\left[A_{t+1}\frac{dy_{t+1}^j}{dS_{t+1}} + N_{t+1}\frac{\partial y_{t+1}^j}{\partial S_{t+1}} - w_{S,t+1} y_{t+1}^j\right]$$

$$= \phi_t^j \eta + \Gamma$$

Where:

$$\Gamma = -\frac{\beta f_y R_t^j}{w_t} - \frac{\beta f_y R_t^j}{w_t}\left[A_{t+1}\frac{dy_{t+1}^j}{dS_{t+1}} + N_{t+1}\frac{\partial y_{t+1}^j}{\partial S_{t+1}} - w_{S,t+1} y_{t+1}^j\right]$$

Lerner Model has stimulated the new imperfect market model development that is *New Empirical Industrial Organization* (NEIO) which was developed by Appelbaum (1981) and Schroeter (1988).

2.1.2. Conjectural Elasticity

Conjectural Elasticity is another indicator which can be used to measure the power of oligopoly market; Appelbaum (1982) formulated the rate power of oligopoly market as:

$$\frac{p - mc}{p} = \frac{\theta^j}{\varepsilon} = \frac{(1+v)m^j}{\varepsilon} \tag{12}$$

Where

$\theta^j = \frac{\partial y}{\partial y^j}\frac{y^j}{y}$ *is conjectural elasticity j^{th} industry,*

$v^j = \frac{\partial y}{\partial y^j}$ *is conjectural variation j^{th} company, and*

$\frac{y^j}{y}$ *is market share j^{th} company.*

The simple model of Appelbaum is developed if oligopolies faces cost function and demand function. If industrial cost function j^{th} is shown by $C^j = C^j (y^j, w)$where y^j is industry outputj^{th} and w is input price vector, so y = j (p,z) as demand function where p means output price and z means shifter demand vectors. Industry profit maximization j^{th} is shown by (13).

$$max\ [py^j - C^j\ (y^j, w): y = J\ (p,z)] \tag{13}$$

where $y = \sum_j y^j$

The optimum condition which is suitable with profit maximization problem which is given to (13) is shown by (14).

$$P(1+\frac{\theta^j}{\eta}) = \frac{\partial C^j(y^j, w)}{\partial C^j} \tag{14}$$

Where:

$$\eta = \frac{\partial y}{\partial P}.\frac{P}{y}$$

If demand elasticity for normal stuff is always negative, it can be formulated as: if $\theta^j$is positive, industry can gain the higher price than in competitive market. If demand elasticity is constant, conjectural elasticity and price will be higher. This condition shows that market power is higher.

Figure 1 describes the equation condition (14) in graphic form where p $(1+ \theta^j/ \eta)$ is marginal revenue (MR) and $\delta C^j(y^j, w)/ \delta y^j$ is marginal cost (MC). The equilibrium is on E point. Price is prescribed in p when Q^j quantity is intersected with the demand of company product ($D^j = r^j.D^m$) in which D^j and D^m is the product demand of industry and market and r^j is industry market stock. This market is in equilibrium in price p and quantity Q^m.

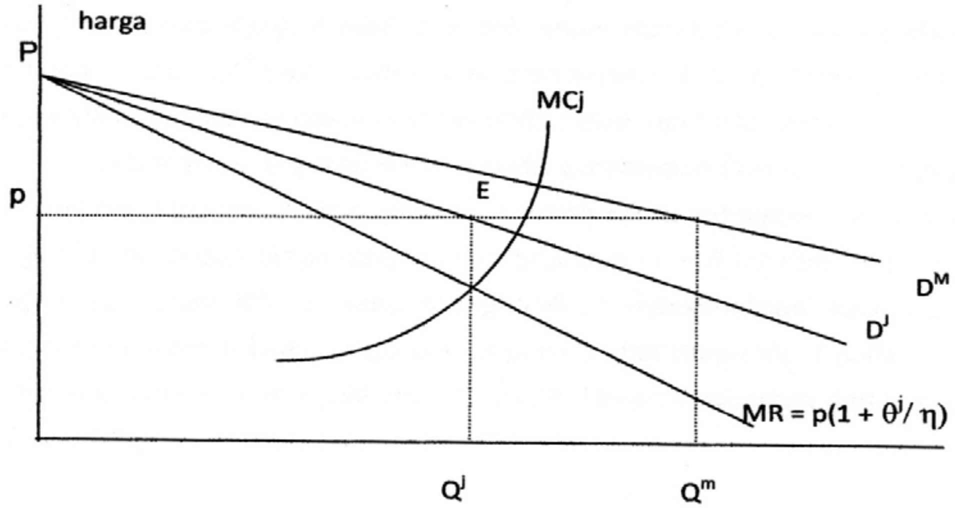

Figure 1. Industry Pricing J^{th} in Imperfect Market Structure when only Output Market Price is considered (Adapted from Schroeter, 1988). (harga=price)

More complex model (Schroeter, 1988) indicates the problem when industry j^{th} faces demand that is given for output and supply that is given for input. This analysis needs the separation of interest cost of raw material input from the total cost. Because of that, industry profit function can be written in this equation (15).

$$\pi = p.yj - Wr.Rj - Cj(yj, W) \tag{15}$$

Where: W_r refers to the input price of raw material, R^j means the input quantity of raw material which is used by industry j^{th} . Profit maximization condition needs the first equation derivative (15) to output to have zero as the result. Therefore, it can result the equation (16).

$$P(1+\frac{\theta^j}{\eta}) = \frac{W_r}{\tau}(1+\frac{\theta^j}{e}) + MC^{j'} \tag{16}$$

Where; η refers to market demand elasticity, *e* means market supply elasticity, τ = ration of input-output conversion as if $\sum R = y$ or $z R^j = y^{j,}$, $MC^{j'}$= the input marginal cost of non-raw material.

Equation (16) shows that industry can gain maximum profit when MR = MC. Therefore, $p(1+ \theta^j/\eta)$ is industry marginal revenue to product, while $W_r (1 + \theta^j/e)$ is raw material marginal cost to product. The latest must be added in the input marginal cost of non-raw material to get total marginal cost.

This model shows that industry j^{th} can use its profit in product and input market. It is interesting to be observed that conjectural elasticity of company appears in the two sides of equation. It means that industry can use its market power in input and output market.

Figure 2 shows the graphic condition of equation (16) where the input market is combined with the output one. By assuming that the notation is the same like in Figure 1, industry marginal revenue and its marginal cost is $p (1 + \theta^j/\eta)$ and $W_r (1 + \theta^j/e) + \delta^j/\delta y^\delta$ that intersect in E point and result profit maximization for industry. Industry will decide the output price in p and the input price in W_r. It buys raw material input and sells products Q^j unit. Equilibrium price and market quantity are p,W_r and Q^M.

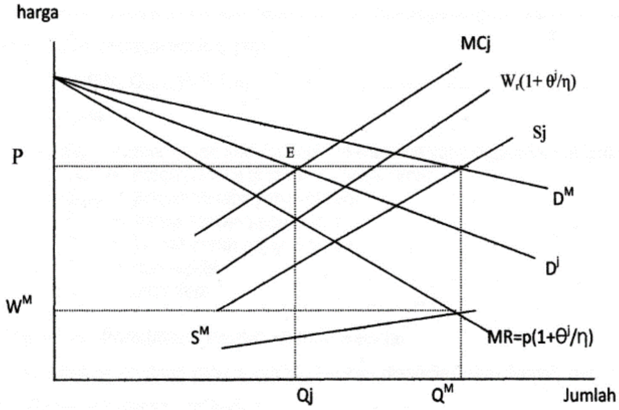

Figure 2. Industry PricingJ^{th} in Imperfect Market Structure when Input and Output Market are Considered at the Same Time (Adapted from Schroeter, 1988). (harga=price; jumlah=total).

2.2. Statistical Analyses

2.2.1. Research Data

Data used in this research was the statistic data of *Time series* (1989-2008) which was gotten from Statistic Center Board, Agriculture Ministry and related institutions in East Java. Data was estimated by using OLS

(*Ordinary Least Square*). Before estimating the data, the stationary condition of every variable was tested by using ADF Test (*Augmented Dickey-Fuller Test*).

2.3. Analysis Model

2.3.1. Market Power Analysis

Model which is used to analyze oligopoly market power in soybean market is oligopoly model from Appelbaum - Schroeter (1982). This model uses conjectural elasticity to measure market power. The benefit of conjectural elasticity is it can measure price power in input and output market of soybean market, while Lerner Index only tends to measure market power in output market. Soybean industry is used s the analysis unit because it faces the demand given for output and the supply given for input. Therefore, it will be known how strong market power can influence soybean price both in input and output markets. The formula below is used to know how strong oligopoly market can influence the price in soybean market:

$$P(1+\frac{\theta^{j}}{\eta}) = \frac{W_r}{\tau}(1+\frac{\theta^{j}}{e}) + MC^{j'} \tag{17}$$

Where: P is the output price of processed soybean, e means the supply elasticity of soybean seed, η means the output demand elasticity of processed soybean, W_r is the wholesale price of soybean, τ = the conversion ratio of soybean input-output becoming processed soybean product, MC^j is marginal cost of soybean industry, and θ^j means industry conjectural elasticity

2.3.2. Soybean Supply Elasticity

Soybean supply elasticity is estimated from soybean supply function. Soybean supply is formulated as the equation below (18)

$$\mathrm{Qs} = \mathrm{f(Wr, Qsimp, Pn, F, T.e)} \tag{18}$$

where:
Q_s = the supply of level two soybean which is used in soybean industry
W_r= wholesale soybean price in East Java
Q_{simp}= the total of imported soybean
P_n = retail price of Urea fertilizer
F = the amount of annual rainfall
T = trend of time
e = error item

2.3.3. Supply Elasticity of Processed Soybean Product

Supply elasticity of processed soybeanproduct is estimated from demand function of total market for processed product made from soybean.

$$(Q_{ds} + Q_{dsimp} - \Delta S) = f(P_t, P_{po}, I, e) \tag{19}$$

where:
Q_{ds} = total supply of processed soybean product from company
O_{dsimp}= volume of imported processed soybean product
ΔS = changing in the stock of processed soybean
P_t= price of processed soybeanproduct
P_{po} = price of processed product made from other materials

I = consumer per capita income
ε_o = error

2.3.4. Marginal Cost (MC^j)

Theoretical model differentiates material input cost from other inputs. Appelbaum (1982), Schroter (1988), Sexton (1990) suggest Leontief generalized finance function to be assumed as output linear function. It shows constant marginal cost for the cost of industry raw material. The functional form of raw material cost is formulated in this equation below (20)

$$TC' = \omega_0 + \omega_1.Q_d \quad (20)$$

Where:
TC = total cost of processed soybean product process
ω_0= total fixed cost
ω_1= marginal cost of raw material input
Q_d= total output of processed soybean product
From that equation (20), ω_1 refers to marginal cost of raw material input, not from soybean itself, which is the result of equation differentiation (20) to output (Q_d) or the value of *MC*.

2.3.5. Conjectural Elasticity (Market Power)

Conjectural elasticity is estimated from the equation (17) so that it is gained the equation (21) below:

$$P + P\frac{\theta^j}{\eta} = \frac{W_r}{\tau} + \left(\frac{Wr}{\tau}.\frac{\theta^j}{e}\right) + MC^{j'} \quad (21)$$

From the equation (21), conjectural elasticity can be estimated as the equation (22) and (23):

$$\left(P.\frac{\theta^j}{\eta}\right) - \left(\frac{Wr}{\tau}.\frac{\theta^j}{e}\right) = \frac{Wr}{\tau} + MC^{j'} - P \quad (22)$$

$$\theta^j = \left(\frac{Wr}{\tau} + MC^{j'} - P\right) \Big/ \left(\frac{p}{\eta} - \frac{Wr}{\tau.e}\right) \quad (23)$$

3. Result and Discussion

3.1. Conjectural Elasticity

Conjectural elasticity is the parameter which is used to measure oligopoly market power in soybean market in influencing input and output prices. The value of conjectural elasticity = 0,3916 which is not the same as zero significantly influences price in soybean market. According to Alppelbaum – Schroter. (1982), high conjectural elasticity can give the strong power for industry to have the power market both in input and output markets. On the other hand, low conjectural elasticity only gives the weak power for industry in input and output markets. This condition will also happen if industry does not have any market power in pricing.

3.2. Market Power Analysis in Soybean Market

Oligopoly market power is shown on Table 1, without the consideration of market power, soybean wholesale price in input market is Rp. 3.210,17/kg and the price of processed soybean product in output market is Rp. 7.273,00/kg. However, if power market is considered, the power of oligopoly market in soybean market can raise the price in input market as much as 19,39 percent for the soybean wholesale price from Rp 3.210,17/kg becomes Rp. 3.833,48/kg, and oligopoly market power can raise the price in output one as much as 38,81 percent for the price of processed soybean product from Rp 7.273,00/kg becomes Rp. 10.095,70/kg. If soybean marginal price in farmer level and soybean wholesale price in wholesalers level is assumed as much as 26,14 percent, the soybean price in farmer level should raise from Rp 2.371,40 becomes Rp 2.831,47/kg. However, the price is difficult, or even never happens, to rise because there is market power influence which leads soybean price in farmer level is still cheap. Graphically, the influence of oligopoly market power for the price in soybean market is shown in Figure 3. It is shown the input and output markets condition that soybean price is fixed if power market is not considered. However, if it is considered, soybean price in input market will raise less than in output market.

Table 1. The analysis of Oligopoly Market Power Influence to Soybean Price in Input and OutputMarket

Variable	Basic Simulation (Rp/kg)	Price Changing (Rp/kg)	Changing Percentage (%)	Soybean Price (Rp/kg)
Without Market Power				
Wholesale Soybean Price (W_r)	3.210,67	0,00	0,00	3.210,67
Soybean Price in Farmer Level (P_f)*	2.371,40*			2.371,40*
Price of Processed Soybean Product (P_t)	7.273,00	0,00	0,00	7.273,00
With Market Power				
Wholesale Soybean Price (W_r)	3.210,67	622,8087	19,39	3.833,48
Soybean Price in Farmer Level (P_f)*	2.371,40*			2.831,47*
Price of Processed Soybean Product (P_t)	7.273,00	2.822,66	38,81	10.095,70

Explanation:)* is assumed as soybean marginal price in farmer level and wholesalers 26,14 %

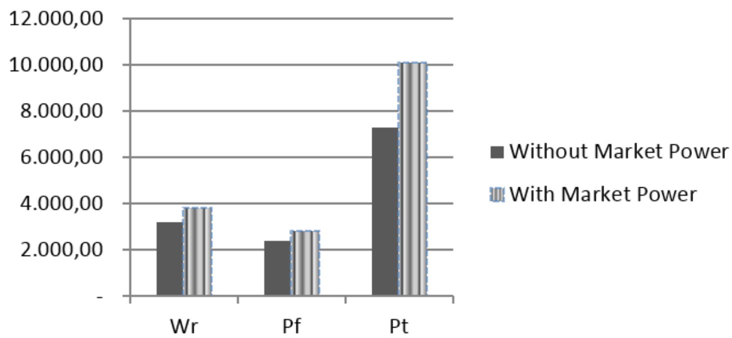

Figure 3. The Influence of Oligopoly Market Power to Soybean Price in Input andOutput Market

4. Conclusion

Market power influences soybean price significantly. Conjectural elasticity as much as 0,3916. Market power can raise the price in input market as much as 19,3981 percent to the wholesale soybean price and it can also raise the price in output market as much as 38,8161 percent to the price of processed soybean product. Therefore, it is hoped that government should have the effective policy in pricing soybean, so that the increasing of local soybean production among farmers can be seized. Besides, the influence of market power to soybean price also should be considered in developing soybean industry.

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